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MODEL BASED SYSTEMS DESIGN FOR GREEN IOT SYSTEMS

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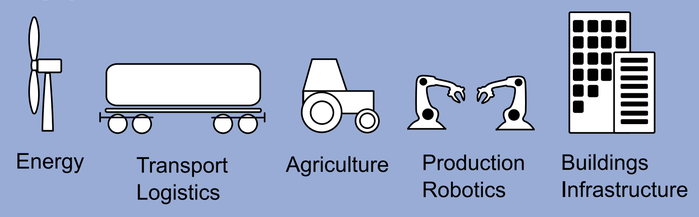
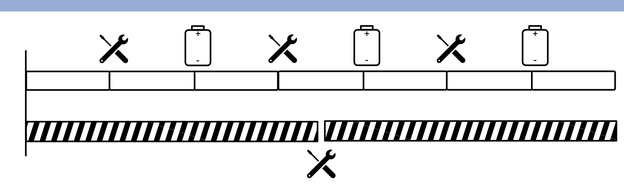
Modern microelectronic systems and wireless communication systems enable the connection of physical objects to the internet of things. Application areas include:



On a global scale, billions of IoT devices are expected to contribute significantly to the world electric power consumption, even just considering the energy for wireless communication.

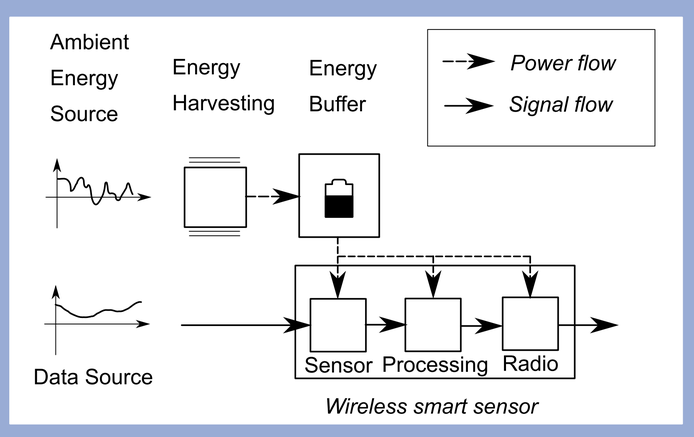
Prognosis 2030
- 26 Billions of IoT devices
- 20% of worldwide greenhouse gas emissions by communication technologies

On the component level, efficient use of energy helps to improve the lifetime of a device, reduce waste, e.g. for batteries and effort for maintenance.



ENERGY RESTRICTIONS FOR WIRELESS IOT SYSTEMS

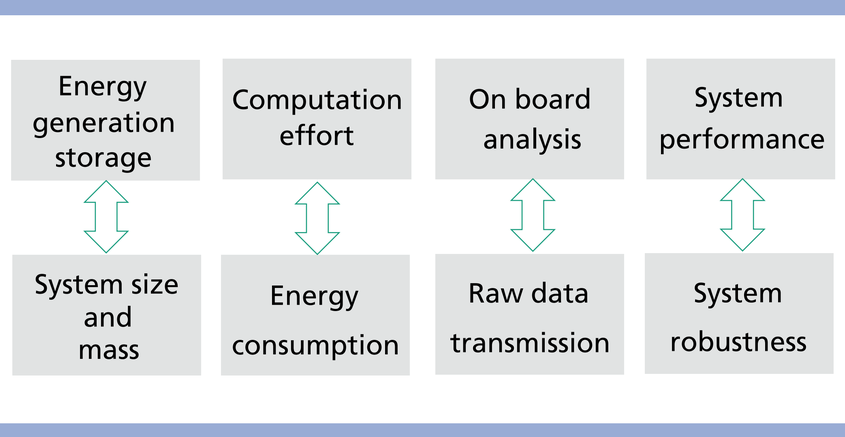
Wireless IoT devices promise the largest benefit when they are operating fully autonomously. A supply by environmental energy harvesting and a low power design is attractive.



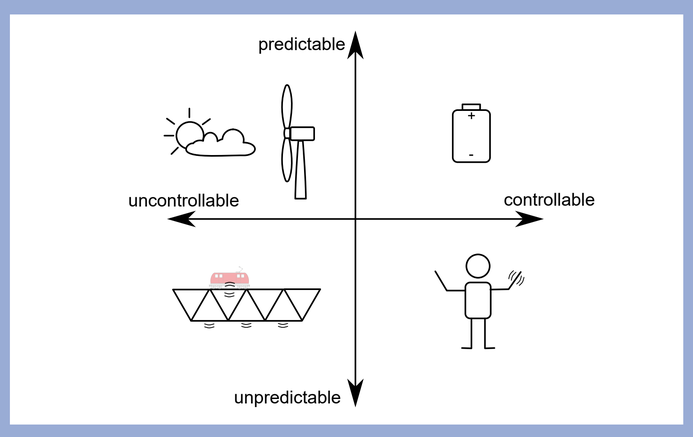
The power consumption has to be balanced with the power supply:

$$\int_0^T P_{EH}(t)dt \geq \int_0^T P_{SYS}(t)dt$$

The system design is a complex multi-criteria optimization task:

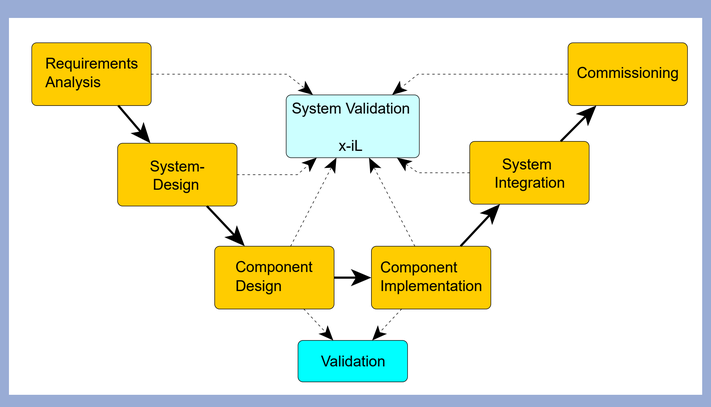


The design and operation scenarios have to regard uncertainties. For instance, the power supply by energy harvesting might be of limited predictability and controllability.

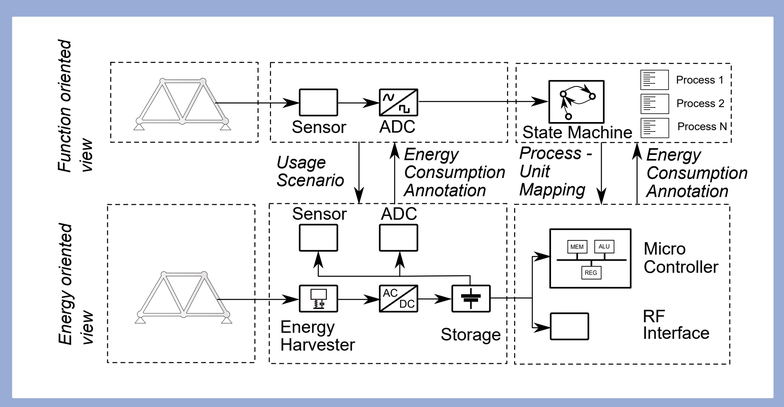


MODEL BASED SYSTEMS DEVELOPMENT AND A PROPOSED SYSTEMS ENGINEERING METHOD

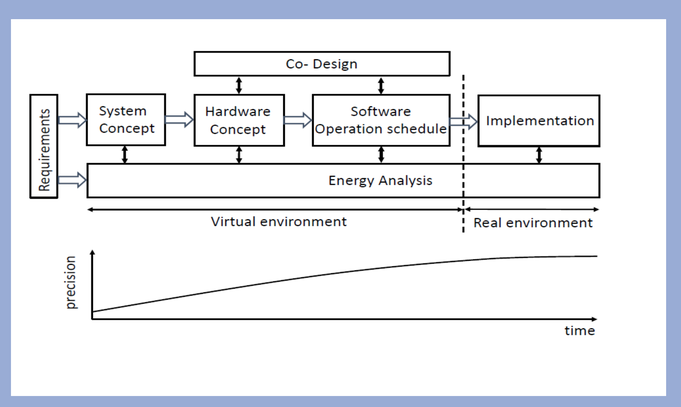
Modern development of cyberphysical systems follows design methods like the V-model. Early, model based validation using simulation increases efficiency and speed of the process.



To include the complex interactions between the components in a model based system design process, a multi physical simulation is needed. The simulation should integrate the functional view and the energy view on the system and the mapping of both, and also couple different domain specific tools.



This enables the continous validation of the energy balance through the design process from rough estimations in the early stage to refined analyses in the later stages, also including hybrid validation like hardware-in-the-loop.



NEXT STEPS

The proposed system simulation will be implemented and tested first at a laboratory example to validate the approach.